A Bosses

A company of n employees is due for a restructuring. In the resulting hierarchy, represented as a rooted tree, every node will be the boss of its children.

Each employee has a list of bosses they will accept. In addition, all employees must be assigned a salary. The salary must be a positive integer, and the salary of each boss must be larger than the sum of salaries of their immediate subordinates.

Your task is to structure the company so that all above conditions hold, and the sum of all the salaries is as small as possible.

Input

The first input line contains an integer n: the number of employees. The employees are numbered $1, 2, \ldots, n$.

After this, the input contains n lines that describe the preferences of the employees. The ith such line contains an integer k_i, followed by a list of k_i integers. The list consists of all employees that the ith employee accepts as their boss.

Output

You should output the lowest total salary among all valid restructurings. You can assume that at least one solution exists.

Example

Input:
```
4
1 4
3 1 3 4
2 1 2
1 3
```

Output:
```
8
```

Subtask 1 (22 points)

- $2 \leq n \leq 10$
- $\sum_{i=1}^{n} k_i \leq 20$

Subtask 2 (45 points)

- $2 \leq n \leq 100$
- $\sum_{i=1}^{n} k_i \leq 200$

Subtask 3 (33 points)

- $2 \leq n \leq 5000$
- $\sum_{i=1}^{n} k_i \leq 10000$

B Park

In the capital of Byteland, there is a fenced park whose area is a rectangle. The trees and the visitors in the park are represented as circles.

There are four entrances in the park, one in each corner (1 = bottom-left, 2 = bottom-right, 3 = top-right, 4 = top-left). The visitors can enter and exit the park only through the entrances.

Visitors can enter and exit the park when they touch both sides of a corner of the corresponding entrance. Visitors can move freely in the park, but they cannot overlap any of the trees or the fence.

Your task is to calculate for each visitor, given the entrance they will enter the park, through which entrances they can exit the park.

Input

The first input line contains two integers n and m: the number of trees in the park and the number of visitors.

The second input line contains two integers w and h: the width and the height of the park area. The bottom-left corner is $(0, 0)$, and the top-right corner is (w, h).

After this, there are n lines that describe the trees. Each line contains three integers x, y and r: the center of the tree is (x, y) and its radius is r. The trees do not overlap each other or the fence.

Finally, there are m lines that describe the visitors. Each line contains two integers r and e: the radius of the visitor and the entrance they will enter the park.

In addition, no tree overlaps a square area of $2k \times 2k$ in each corner, where k is the radius of the largest visitor.

Output

You should output for each visitor a single line containing the entrances through which they can exit the park, in sorted order without spaces in between.

Notes

Two objects touch if they have one common point. Two objects overlap if they have more than one common point.

Example

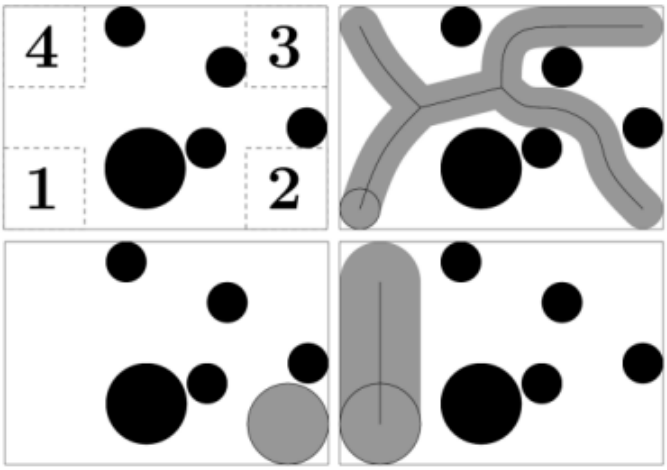
Input:
```
5 3
16 11
11 8 1
6 10 1
7 3 2
```

```
10 4 1
15 5 1
1 1
2 2
2 1
```

Output:

```
1234
2
14
```

The following figure shows the entrance areas and possible routes for each visitor:



Subtasks

In all subtasks $4k < w, h \leq 10^9$ where k is the radius of the largest visitor.

Subtask 1 (27 points)

- $1 \leq n \leq 2000$
- $m = 1$

Subtask 2 (31 points)

- $1 \leq n \leq 200$
- $1 \leq m \leq 10^5$

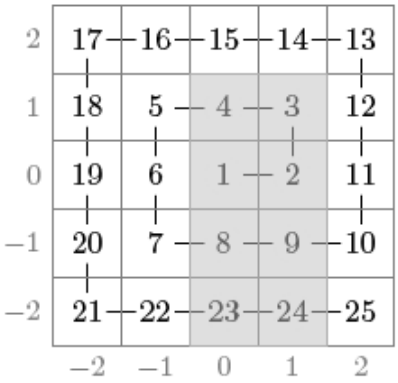
Subtask 3 (42 points)

- $1 \leq n \leq 2000$
- $1 \leq m \leq 10^5$

C Spiral

A grid of size $(2n+1) \times (2n+1)$ has been constructed as follows. Number 1 has been placed in the center square, number 2 has been placed to the right of it, and the following numbers have been placed along the spiral counterclockwise.

Your task is to calculate answers for q queries where the sum of numbers in an rectangular region in the grid is requested (modulo 10^9+7). For example, in the following grid $n=2$ and the sum of numbers in the gray region is 74:



Input

The first input line contains two integers n and q: the size of the grid and the number of queries.

After this, there are q lines, each containing four integers x_1, y_1, x_2 and y_2 ($-n \le x_1 \le x_2 \le n$, $-n \le y_1 \le y_2 \le n$). This means that you should calculate the sum of numbers in a rectangular region with corners (x_1, y_1) and (x_2, y_2).

Output

You should output the answer for each query (modulo 10^9+7).

Example

Input:
```
2 3
0 -2 1 1
-1 0 1 0
1 2 1 2
```

Output:
```
74
9
14
```

Subtasks

In all subtasks $1 \le q \le 100$.

Subtask 1 (12 points)

- $1 \leq n \leq 1000$

Subtask 2 (15 points)

- $1 \leq n \leq 10^9$
- $x_1 = x_2$ and $y_1 = y_2$

Subtask 3 (17 points)

- $1 \leq n \leq 10^5$

Subtask 4 (31 points)

- $1 \leq n \leq 10^9$
- $x_1 = y_1 = 1$

Subtask 5 (25 points)

- $1 \leq n \leq 10^9$